

DIRECTIONS

Evaluate the student by checking the appropriate box to indicate the degree of competency. The rating for each competency should reflect **employability readiness** rather than the grades given in class.

Rating Scale:

0 No Exposure

1 Introduced – The student has been exposed through non-participation instruction (e. g., lecture, demonstration, field trip, video).

2 Practiced – The student can perform the task with direct supervision.

3 Entry-level Competency – The student can perform the task with limited supervision and/or does not perform the task to standard (a typical entry-level performance expectation)

4 Competency – The student consistently performs task to standard with no supervision (on at least two occasions or at instructor’s option)

PRECISION MACHINING TECHNOLOGY 48.0503

0 1 2 3 4

“ “ “ “ “

A. SAFETY

- *A. 1 Pass a program safety test with 100% accuracy.
- *A. 2 Define specific safety terms.
- *A. 3 Demonstrate use of safety clothing; eye, ear, and face protection; aprons and shields; and other safety equipment.
- *A. 4 Demonstrate knowledge of safety rules.
- *A. 5 Recognize and report unsafe working conditions to the supervisor and/or safety observer.
- *A. 6 Maintain work area in a clean and safe condition.
- *A. 7 Follow shop accident and injury procedures.
- *A. 8 Handle hazardous materials according to “Right to Know” regulations.

“ “ “ “ “

B. APPLIED MATHEMATICS AND MEASUREMENT

- *B. 1 Demonstrate basic knowledge of the history of measurement systems.

*B. 2 Demonstrate knowledge of the use and application of the following tools:

Steel Rules
Rule Depth Gauge
Elements of a Combination Set
Precision Steel Square
Center Gauge
Screw Pitch Gauge
Small Hole Gauges
Telescoping Gauges
Micrometers
Dual Indicating Gauges
Gauge Blocks
Go, No Go Gauges
Radius Gauge

*B. 3 Transfer measurements from blueprints to the part upon which work is being done.

*B. 4 Select the correct tooling for various type of measurement and layout work.

*B. 5 Measure diameters, thicknesses, depths, and angles within stated tolerances.

*B. 6 Demonstrate proficiency in calculations using whole number, fractional, and decimal operations.

*B. 7 Demonstrate proficiency in technical application of calculations in angular and linear problems.

*B. 8 Apply mathematical formulas, reference books (Machinist's Handbook,...), and reference charts used in machine trades.

*B. 9 Estimate job costs in time and materials.

*B. 10 Use sine bars and sine plates in combination with gauge blocks.

*B. 11 Observe operation of a coordinate measurement machine (field trip).

*B. 12 Observe application of Statistical Process Control (SPC) procedures in a manufacturing setting (field trip).

*B. 13 Observe operation of an optical comparitor (field trip).

“ “ “ “

C. PRINT READING

- *C. 1 Define basic blueprint terminology such as title block, border, views, notes, revision blocks, etc. Recognize the intent of the drawing and its use in manufacturing.
- *C. 2 Differentiate between dimensions of location and size. These dimensions may be represented as ordinate, base line, tabular, etc.
- *C. 3 Identify general note symbols and their applications within a manufacturing environment. Examples of symbols include finishing requirements, material specifications, machining/manufacturing specifications, assembly symbols, ANSI symbols, ISO symbols, etc.
- *C. 4 Locate notes on a print using industry standards, using three drawings with two minutes per note and 100% accuracy.
- *C. 5 Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment, using three drawings with five abbreviations or terms each with 100% accuracy and a limit of two minutes per term/abbreviation. To be documented by a third party observer.
- *C. 6 Given a drawing, the individual must distinguish the tolerance that applies to a specific dimension.
- *C. 7 Identify the representation of the various lines found on a drawing. Examples include hidden lines, object lines, extension lines, section lines. Individuals should read various drawings and identify lines with 100% accuracy.
- *C. 8 Interpret the following information from a blueprint title block: company name, part name and number, material, name of designer and checker, revision history, and other important information regarding the part.
- *C. 9 Interpret the meaning of revision block symbols and notations. Match the revision block components with the actual drawing features.
- *C. 10 Recognize the three basic views which may be represented on the drawing: front, top, right side. Identify if the print is drawn in first or third angle projections. Detect features represented in one view and find those same features in another view.
- *C. 11 On a drawing containing orthographic and isometric, properly identify the isometric view. Provide a 50-word description of what constitutes an isometric view and its relation to orthographic views.

- *C. 12 Given an orthographic drawing, identify all appropriate views according to their position or placement on print. Or, given an actual part, the individual will be able to match the views to the appropriate surfaces.
- *C. 13 Visualize one or more views from a given isometric or pictorial representation of an object, or from the actual object.
- *C. 14 Based on the title block information, physical scaling of view, and standard drawing scale, determine appropriate scale of view or section.
- *C. 15 Given a series of drawings, some of which contain revisions and proper notation, properly identify which ones are the most current revisions, and identify which drawings do not contain revisions.

“ “ “ “ **D. METALLURGY**

- *D. 1 Pass a safety test with 100% accuracy.
- *D. 2 Define specific metal and alloy terminology.
- *D. 3 Identify ferrous and nonferrous metals.
- *D. 4 Demonstrate the chemical composition of metals by using the AISI, SAE, and color-code systems.
- *D. 5 Demonstrate knowledge of the physical and mechanical properties of metals, alloys, and other materials.
- *D. 6 Perform experiments showing the different physical and mechanical properties of materials.
- *D. 7 Identify metals using the spark test.
- *D. 8 Define specific heat treatment terminology.
- *D. 9 Demonstrate procedures for hardening, tempering, annealing, and case hardening, documenting data and resources for procedures.
- *D. 10 Demonstrate knowledge of heat treatment equipment.
- *D. 11 Perform heat treatment processes on specific metals, documenting results.
- *D. 12 Select cooling media for specific materials.
- *D. 13 Demonstrate quenching of materials.
- *D. 14 Define specific hardness testing terminology.

- *D. 15 Demonstrate hardness testing with a file.
- *D. 16 Demonstrate hardness testing machine procedures (Rockwell, Brinell, Scleroscope,...).
- *D. 17 Demonstrate hardness testing of flat and/or round stock.
- *D. 18 Demonstrate conversion of hardness values from one harness testing method to another.

“ “ “ “ “ **E.HAND, BENCH, AND PORTABLE POWER TOOLS**

- *E. 1 Pass a hand tool safety test with 100% accuracy.
- *E. 2 Define specific hand tool terminology.
- *E. 3 Identify common hand tools (listed by AVC).
- *E. 4 Demonstrate use of various types of hand tools in the following operations:
 - a. Assembling: screw drivers, wrenches, punches, and hammers.
 - b. Cutting: hacksaws, files, chisels, and shears.
 - c. Abrading, coated, stick, wheel, and compound.
 - d. Threading: taps and dies.
- *E. 5 Demonstrate the use of common power hand tools.
- *E. 6 Select tools for a specific application.
- *E. 7 Demonstrate knowledge and use of the following tools and equipment: layout die, steel rule, scribe, dividers, prick punch, surface plate, straight edge, v-block, surface gauge, c-clamps, toolmaker's clamps, and combination set.
- *E. 8 Demonstrate knowledge and use of the following hand and power tools: hand hacksaw, power hack saw, power band saw, hand drill, hand reamer, hand taps and dies, and cold chisel.
- *E. 9 Demonstrate knowledge of assembly fits: sliding, press, and shrink.

“ “ “ “ “ **F. ABRASIVE AND GRINDING TECHNOLOGY**

- *F. 1 Pass a pedestal/bench grinder safety test with 100% accuracy.
- *F. 2 Define specific grinder terms.

- *F. 3 Inspect and set up machine for safe working order, reporting unsafe conditions to supervisor and/or safety observer.
- *F. 4 Demonstrate selection, mounting, and dressing of grinding wheels and setting of tool rest and guards.
- *F. 5 Demonstrate offhand grinding of hand tools, lathe turning tools, and drill bits.
- *F. 6 Sharpen tools to specified tolerances.
- *F. 7 Pass a surface grinder safety test with 100% accuracy.
- *F. 8 Define surface grinder terminology.
- *F. 9 Select, ring test, and mount a wheel that has the correct grain, structure, and bond for a specific application.
- *F. 10 Demonstrate procedures to: a) balance a wheel, and b) true and dress a wheel.
- *F. 11 Perform the following operations to specified tolerances: plunge-cut, angular, cut-off, shoulder, and parallel grinding.
- *F. 12 Select proper feed rates.
- *F. 13 Perform machine safety inspection, reporting unsafe conditions to the supervisor and/or safety observer.
- *F. 14 Identify and demonstrate the use of sine bars, vises, and v-blocks.
- *F. 15 Perform cutter-grinding operations.

“ “ “ “ **G. TURNING TECHNOLOGY**

- *G. 1 Pass an engine lathe safety test with 100% accuracy.
- *G. 2 Define specific engine lathe terms.
- *G. 3 Demonstrate knowledge of the causes of vibrations and how to eliminate them.
- *G. 4 Examine tools for safety and sharpness, reporting unsafe conditions to supervisor and/or safety observer.
- *G. 5 Inspect machine for safe working order and report unsafe conditions to supervisor and/or safety observer.

- *G. 6 Calculate and set speeds and feeds.
- *G. 7 Sharpen lathe tool bits accurately.
- *G. 8 Mount work between centers.
- *G. 9 Mount and remove lathe chucks.
- *G. 10 Center work in independent and universal chucks.
- *G. 11 Mount work in faceplate.
- *G. 12 Perform external facing operations.
- *G. 13 Perform external turning operations.
- *G. 14 Perform internal turning operations.
- *G. 15 Perform reaming operations.
- *G. 16 Perform tapering operations.
- *G. 17 Bore holes on a lathe.
- *G. 18 Cut external and internal threads.
- *G. 19 Machine work on mandrel.
- *G. 20 Perform cutting off operations.
- *G. 21 File and polish product to an acceptable finish.
- *G. 22 Machine products to specified tolerances.
- *G. 23 Perform knurling operations.
- *G. 24 Demonstrate knowledge of the use and grades of carbide.

“ “ “ “ **H. MILLING TECHNOLOGY**

- *H. 1 Pass a milling machine safety test with 100% accuracy.
- *H. 2 Define specific milling machine terms.
- *H. 3 Demonstrate knowledge of the differences among types of end milling cutters.
- *H. 4 Demonstrate knowledge of the concept of backlash.

- *H. 5 Demonstrate conventional and climb milling, and the uses of each.
- *H. 6 Demonstrate knowledge of the causes of machine vibrations and how to eliminate them.
- *H. 7 Select and install the proper tooling for a milling machine application.
- *H. 8 Examine milling cutters for sharpness, reporting unsafe conditions to supervisor and/or safety observer.
- *H. 9 Demonstrate machine check for safe working order, reporting unsafe conditions to supervisor and/or safety observer.
- *H. 10 Calculate and set speeds and feeds.
- *H. 11 Demonstrate traming the head and squaring the vise.
- *H. 12 Perform operations (plain and face, conventional and climb milling).
- *H. 13 Machine a flat surface.
- *H. 14 Machine a work piece square.
- *H. 15 Perform form operations using the dividing head.
- *H. 16 Perform rotary table operations.
- *H. 17 Machine grooves and keyways.
- *H. 18 Perform drilling, reaming, and boring operations.
- *H. 19 Perform cut-off operation (slitting saw).
- *H. 20 Machine flat surface using a fly cutter.
- *H. 21 Machine products to specified tolerances.
- *H. 22 Set up gear train for dividing head to perform cam and gear cutting operations.
- *H. 23 Demonstrate knowledge of jig boring procedures.
- *H. 24 Demonstrate procedures to set vises and fixtures.
- *H. 25 Perform specific side milling operations.
- *H. 26 Perform slab milling operations.

*H. 27 Perform gang milling operations.

“ “ “ “ “ **I. SAWING TECHNOLOGY**

- *I. 1 Pass a band saw safety test with 100% accuracy.
- *I. 2 Define specific band saw terms.
- *I. 3 Perform preventive maintenance.
- *I. 4 Adjust cutting speeds for specific materials.
- *I. 5 Perform machine adjustments: guides, inserts, tensions, speed, tilt table, coolant, and air.
- *I. 6 Demonstrate blade changing procedures.
- *I. 7 Select proper tooling for a specific job.
- *I. 8 Examine cutting tools for safety and sharpness, reporting unsafe conditions to supervisor and/or safety observer.
- *I. 9 Inspect machine for safe working order and report unsafe conditions to supervisor and/or safety observer.
- *I. 10 Perform specific cutting operations.
- *I. 11 Machine products to specified tolerances.
- *I. 12 Perform blade welding procedures.

“ “ “ “ “ **J. DRILLING TECHNOLOGY**

- *J. 1 Pass a drill press/radial drill safety test with 100% accuracy.
- *J. 2 Select and install the proper tooling for a specific drill press operation.
- *J. 3 Examine drill press cutting tools for sharpness, reporting unsafe conditions to the supervisor and/or safety observer.
- *J. 4 Inspect drilling machines for safe working order, reporting unsafe conditions to the supervisor and/or safety observer.
- *J. 5 Calculate and set speeds and feeds.
- *J. 6 Demonstrate drill bit sharpening procedures.

- *J. 7 Demonstrate drilling and reaming operations.
- *J. 8 Demonstrate tapping operations.
- *J. 9 Demonstrate spot-facing operations.
- *J. 10 Demonstrate counterbore and countersink operations.
- *J. 11 Demonstrate lapping operations.
- *J. 12 Machine product to specified tolerances.

“ “ “ “ “ **K. ASSEMBLY AND FABRICATION**

- *K. 1 Define Specific fastener terms.
- *K. 2 Demonstrate knowledge of fastening methods.
- *K. 3 Identify various types of fasteners.
- *K. 4 Select appropriate fasteners for a specific application.

“ “ “ “ “ **L.COMPUTER NUMERICAL CONTROL**

- *L. 1 Pass a safety test with 100% accuracy.
- *L. 2 Identify NC and CNC applications.
- *L. 3 Demonstrate knowledge of the advantages and disadvantages of NC and CNC.
- *L. 4 Demonstrate knowledge of the history of NC and CNC development.
- *L. 5 Define specific NC and CNC terminology.
- *L. 6 Demonstrate programming knowledge of NC and CNC equipment.
- *L. 7 Demonstrate knowledge of positioning systems.
- *L. 8 Identify the major components NC and CNC systems.
- *L. 9 Participate in a shadow program focusing on NC and CNC industrial applications.